

**Telangana State Council of Higher Education, Govt. of Telangana
B.Sc. CBCS Common Core Syllabi for all Universities in Telangana**

**Department of Genetics
Scheme Pattern in Genetics for BSc Course- CBCS**

Semester	Course Type	Credits/ Theory	Teaching hours/week- Theory	Credits - Practicals	Lab hours/week- Practical	Dept. workload/ week/ section
ONE	BS106- Classical Genetics	4	4	1	2	6
TWO	BS206- Cytogenetics	4	4	1	2	6
THREE	BS306- Molecular Genetics	4	4	1	2	6
FOUR	BS406- Microbial Genetics & Genetic Engineering	4	4	1	2	6

**BSc GENETICS II Year
SEMESTER- III
BS306: MOLECULAR GENETICS**

Unit 1: Nucleic acids

- 1.1 DNA as the genetic material- Griffiths transformation experiment, Avery, MacLeod and McCarty's experiments and Hershey & Chase phage-labelling experiment
- 1.2 RNA as genetic material- tobacco mosaic virus
- 1.3 Chemistry of Nucleic acids- Nucleotides, Franklin's X-ray crystallography, Chargaff's rule, Watson-Crick model and forms of DNA (A, B & Z); types of RNA (rRNA, mRNA & tRNA)
- 1.4 DNA replication- conservative, semi-conservative and dispersive models, Meselson–Stahl experiment
- 1.5 DNA replicative enzymes (DNA polymerases, helicase, primase, ligase, telomerase, nuclease & topoisomerases) and proteins (initiator protein & single strand binding proteins)
- 1.6 Mechanisms of DNA replication- linear, circular, rolling circle, D-loop and θ -models

Unit 2: Gene expression and regulation in prokaryotes

- 2.1 Structure of prokaryotic gene (promoter, initiator & terminator regions), structure and functions of RNA polymerase & its subunits
- 2.2 Transcription mechanism- initiation, elongation & proof reading, termination (rho independent & rho dependent); reverse transcription
- 2.3 Genetic code- properties, deciphering of genetic code, Wobble hypothesis, aminoacylation
- 2.4 Translation mechanism- initiation, elongation and termination
- 2.5 Prokaryotic transcriptional regulation (negative control & positive control)
- 2.6 Operon concept- lac operon & glucose effect, tryptophan operon

Unit 3: Gene expression and regulation in eukaryotes

- 3.1 Structure of eukaryotic gene (promoter, exons, introns, terminator, enhancer & silencer)
- 3.2 Transcriptional machinery in eukaryotes (RNA polymerases) and their structural and functional features
- 3.3 Transcription- initiation, elongation and termination
- 3.4 Post-transcriptional modifications- capping, polyadenylation, splicing and alternate splicing, rRNA and tRNA splicing
- 3.5 Translation- initiation, elongation and termination
- 3.6 Post-translational modifications- glycosylation, lipidation, acetylation, ubiquitination and chaperones

Unit 4: Mutations and repair mechanisms

- 4.1 Mutations- spontaneous mutations (tautomerism, depurination, deamination, slipped strand mispairing, errors in DNA replication and repair),
- 4.2 Induced mutations- mutagens, physical and chemical mutagens
- 4.3 Types of mutations- transition, transversion, frame shift, silent, lethal mutations, mis-sense and non-sense
- 4.4 DNA damage & repair mechanisms- direct, excision and methyl mediated mismatch, recombinational and SOS repair
- 4.5 DNA recombination- homologous, site specific recombination and non-homologous end joining (NHEJ)
- 4.6 Diseases caused due to mutation- sickle cell anaemia and cystic fibrosis

PRACTICALS

PAPER III (BS306): MOLECULAR GENETICS

1. Extraction of genomic DNA from plant tissue
2. Extraction of genomic DNA from animal tissue
3. Quantification of DNA by spectrophotometer
4. Agarose gel electrophoresis of DNA
5. Estimation of DNA by DPA method
6. Estimation of RNA by orcinol method
7. Separation of proteins by SDS-PAGE
8. Effect of UV on bacterial growth

RECOMMENDED BOOKS

1. Principles of Genetics- Irwin Herscowitz
2. Molecular Biology of the gene - Watson, Hopkins, Roberts, Steitz and Weiner
3. Genes- Benjamin Levin
4. General virology- Luria, Darnell, Baltimore and Campbell
5. Molecular Biology- David Freifelder
6. Practical Microbiology- Aneja
7. Principles and Techniques of Biochemistry and Molecular Biology- Keith Wilson, John Walker
8. Text book of cell and molecular Biology- Ajoy Paul; Books and allied pvt ltd
9. Essentials of molecular Biology by George M. Malacinski; Narosa publications

**BSC GENETICS II Year
SEMESTER- IV
BS406: MICROBIAL GENETICS AND GENETIC ENGINEERING**

Unit 1: Bacterial recombination and mapping

- 1.1 Bacteria- structure, techniques of cultivation, counting
- 1.2 Bacterial phenotypes- colony morphology, nutritional requirement, resistance and sensitivity
- 1.3 Transformation: discovery of transformation- competence of bacterial cells; mechanism of transformation; gene mapping by transformation.
- 1.4 Conjugation- unidirectional gene transfer- F^+ and F^-
- 1.5 High frequency recombination, interrupted mating experiment
- 1.6 Gene mapping by conjugation

Unit 2: Genetics of bacteriophages

- 2.1 Structure and classification of bacteriophages
- 2.2 Lytic cycle- infection of host cells; formation of viral components; maturation and release of virus particles
- 2.3 Lysogeny- nature of lysogeny; λ -phage, integration of viral genome into host genome; lysogenic stage and prophage cycle; factors governing lysogeny
- 2.4 Transduction: generalized transduction, co-transduction and linkage; Mapping by co-transduction
- 2.5 Specialized transduction- formation of specialized transducing particle from a λ -lysogen
- 2.6 Specialized transduction from λ gal and λ bio

Unit 3: Genetic engineering

- 3.1 Introduction to r-DNA technology; enzymes used in molecular cloning- restriction endonucleases, DNA modifying enzymes- methylases, polymerases, ligases and phosphatases
- 3.2 Vectors used in cloning: *E.Coli*, plasmid vectors- pBR322, pUC vectors; cosmids; shuttle vectors- yeast vectors
- 3.3 Genomic libraries: strategies for construction of genomic libraries
- 3.4 cDNA libraries: strategies for construction of cDNA libraries
- 3.5 Blotting techniques (southern, western & northern) and PCR
- 3.6 Screening for detection of cloned genes- antibiotic resistance, blue-white screening

Unit 4: Applications of genetic engineering

- 4.1 Gene products in medicine- Humulin, Erythropoietin, Growth hormone/Somatostatin, tPA, Interferon- γ
- 4.2 DNA based vaccines; Subunit vaccines- Herpes simplex virus; Attenuated vaccines- Cholera
- 4.3 Environment- genetically engineered microorganisms for bioremediation, phytoremediation
- 4.4 Transgenic plants- Bt cotton, Golden rice
- 4.5 Transgenic animals: Molecular pharming- Buffalo and Goat
- 4.6 Industrial products- Cheese and Yoghurt

PRACTICALS

PAPER IV (BS406): MICROBIAL GENETICS AND GENETIC ENGINEERING

1. Methods of sterilization, media preparation
2. Gram staining
3. Isolation, purification and maintenance of bacteria
4. Bacterial growth curve
5. Induction and isolation of mutants in bacteria
6. Preparation of competent cells of bacteria
7. Amplification of gene of interest by PCR
8. Restriction digestion analysis
9. Problems on restriction mapping

RECOMMENDED BOOKS

1. Microbial Genetics By Maloy, Freifelder
2. Molecular Genetics By Gunther and Stent
3. Microbiology By Prescott
4. Genetic Analysis By Griffith, Suzuki and others
5. Microbiology : Concepts and Applications By John Wiley
6. General Microbiology By Stanier
7. Microbiology By Pelczar
8. Introductory Microbiology By J. Heritage
9. Fundamentals of Medical Biotechnology By Irfan Ali Khan and Atiya Khanum